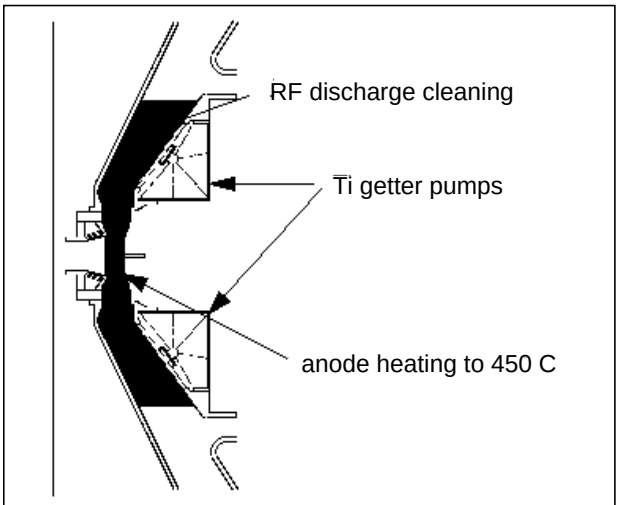
June 1994 Highlights of the Light Ion Inertial Confinement Fusion Program



New hub hardware for PBFA II to provide clean lithium emission surface.

We completed the PBFA-II power coupling series and prepared for the lithium target series, which begins the first week of July. Presentations on light ion ICF and the National Ignition Facility were given at the 21st IEEE International Conference on Plasma Science, the 11th ANS Topical Meeting on Technology of Fusion Energy, the Tenth International Conference on High Power Particle Beams, and to the ICFAC.

The six PBFA-II shots in June that completed the power coupling series suggest better azimuthal symmetry will give higher intensity on target. A cathode with replaceable tips was successfully tested during the series. Damage to a bottom insulator stack ring was repaired in-situ for the first time. The repair took two days; removal of the ring to accomplish the repair could have taken six weeks. The last two shots included a bottom target diagnostic package. Voltage and power density data from Rutherford scattering on these shots will be correlated with line emission spectroscopy to be used on the target shots.

The goal of the July series is to optimize the temperature of the foam-filled hohlraum. In light ion ICF, as opposed to laser ICF, a hole is used in the cylindrical endcap only to diagnose temperature and not also for beam deposition. Two different hole diameters will be used in the 4-mm-diameter cylinder top on separate shots to measure and scale for the rate of hole closure. We fit checked and vacuum tested the target diagnostic packages. The top diagnostic package to measure hohlraum temperature contains a variety of temporal, spatial, and energy-resolving soft x-ray diagnostics. The cylinder bottom will be closed to minimize energy loss and to evaluate an additional temperature diagnostic, based on the difference in shock-breakout time at two portions of a stepped witness plate. A new, time-resolved intensity diagnostic based on beam-induced x-ray emission will be tested during the series. Also, gas transport of the beam will be complete to the target, whereas 1.7 cm radius of vacuum surrounded the target in the previous series.

We finalized the design of new PBFA-II hardware to heat the anode to 450° C, RF clean the surface, and provide local differential vacuum pumping (see figure). This hardware should reduce the “parallel” low-energy ion load by providing a clean lithium emission surface. On SABRE we are testing a new diagnostic that uses a scintillator and a framing camera to measure beam uniformity to a resolution of 1 mm.

A tri-lab (SNL, LBL, LLNL) working group led by SNL will address self-pinched and other transport modes for a possible “common ion driver” using middle-weight ions in a multigap accelerator. The concept will be examined by the joint LIF/HIF communitites to evaluate the possibility of a single LMF/ETF facility for high yield and energy. The first self-pinched transport experiments could be done on SABRE.

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